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United States
Department of
Agriculture

Animal and
Plant Health
Inspection
Service

Plant Protection
and Quarantine

Cooperating State
Departments of
Agriculture

October 1984

ACTION PLAN

D R A F T

ACARINE MITE
Acarapis woodi (Rennie)

~~2X~~
C+H
RF

AUTHORIZATION

This Action Plan provides guidelines and actions for the eradication of an acarine mite infestation. This Action Plan supplements information contained in the Emergency Programs and Administrative Procedures Manuals.

It is to be used in conjunction with other manuals when conducting emergency program activities. The information and instructions contained in this Action Plan were developed with and approved by representatives of cooperating States, the U.S. Department of Agriculture's Agricultural Research and Cooperative State Research Services, and affected industry.

All program technology and methodology employed are determined through discussion, consultation, or agreement with the cooperating State officials.

Addendum D—Life History

1. SYSTEMATIC POSITION

Acarine mite (*Acarapis woodi* (Rennie))

Class: Arachnida
Order: Parasitiformes
Family: Tarsonemidae

There are three species of mites in the genus *Acarapis*. Two are external parasites and are of little importance. The third, *A. woodi*, is an internal parasite and has caused serious losses of bees in the past.

2. IDENTIFICATION CHARACTERS

Adults: The female of *A. woodi* infests the prothoracic tracheal system of the honey bee. The mites (See Figures 1, 2, and 3) are whitish in color and oblong. The female measures 143-174 micro in width. Both female and male lack sensillum or a prodorsal prostigmatic organ. The mouthparts consist of a beaklike gnathosoma with long, bladelike cheliceral stylets that are adapted for piercing and suching. Leg IV is short and slender. In the female leg IV has two long terminal setae and lacks claws. The male has one long terminal seta and one solenidion and also lacks claws. The female of this mite is easily distinguished from other *Acarapis* species by having a shallow indentation on the posterior margin of the coxal plate and by the relatively short leg IV and anterior median apodeme. These morphological characters and the mite's presence in the bee tracheae readily identify *A. woodi* and should prevent confusion with the external mites *A. externus* and *A. dorsalis* .

NOTICE

Recommendations in this Action Plan, which involve the use of pesticides, concern products which are registered or exempted under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Precautions on the pesticide label and all instructions in this Action Plan must be carefully followed.

Federal and/or State personnel may not make any warranty or representations, expressed or implied, concerning the use of these products and shall not be responsible for any loss, damage, or injury sustained as a result of the use of any product as specified in this Action Plan.

The use of trade names in this Action Plan does not imply an endorsement of those products or of the manufacturers thereof by Federal-State pest control programs. Equivalent formulations under different trade names are acceptable.

_____ _____

Deputy Administrator — Date
Plant Protection and Quarantine

_____ _____

Chairman — Date
National Plant Board

I. GENERAL INFORMATION

A. Action Statement

The information contained in this document is intended for use only when an acarine mite infestation is known to exist. This Action Plan is to be used for guidance in implementing eradication procedures and in preventing spread to other locations should it become established. This Action Plan provides technical and general information needed to implement any phase of an acarine mite eradication program. Specific emergency program action is to be based on information available at that time.

B. Background Information

Acarapis woodi was first reported in 1921 on the Isle of Wight, England, it is now known to occur in the USSR, and throughout most of Argentina, Austria, Belgium, Brazil, Canary Islands, Chile, Colombia, Czechoslovakia, France, Germany, Hungary, India, Ireland, Italy Majorca, Netherlands, Pakistan, Poland, Scotland, Spain, Switzerland, Uruguay, Venezuela, Wales, Zaire, and recently in Mexico. See map for distribution.

Acarapis woodi causes acarine disease of the honey bee, Apis mellifera. The Honeybee Act of 1922 was enacted primarily to prevent importing live honey bees infested with acarine disease into the United States. This disease affects flight efficiency and causes a large number of crawling bees that are unable to fly. The inability of bees to fly contributes to losses of field bees and scarcity of food in the colony. In such cases, the colony population could dwindle and ultimately result in the death of the colony. Acarine disease could persist in a colony for years causing little damage, but combined with other diseases, unfavorable conditions, scarcity of pollen, and/or a poor foraging season, the disease significantly increases the mortality of colonies in winter.

The eggs are laid in the tracheae of the bee one at a time. Each female can lay from 5 to 7 eggs. The egg stage may last 3 to 6 days, from which six-legged larvae emerge. The larvae complete their development and emerge as mature adults from the first thoracic spiracle. The adults move from one bee to another until they encounter a young bee before entering the trachea. Bees are infested from about 5 to 9 days old.

C. Life History Application

The acarine mite reproduces in bees throughout the year and spreads from bee to bee whenever young bees less than 9 days old are available. Mites are detected only through microscopic examination and program activities will be guided chiefly by the detection of mites in the tracheae and to some extent by bee and hive behavior which can indicate an infestation.

Emergency Programs

Acarine Mite Distribution

1983

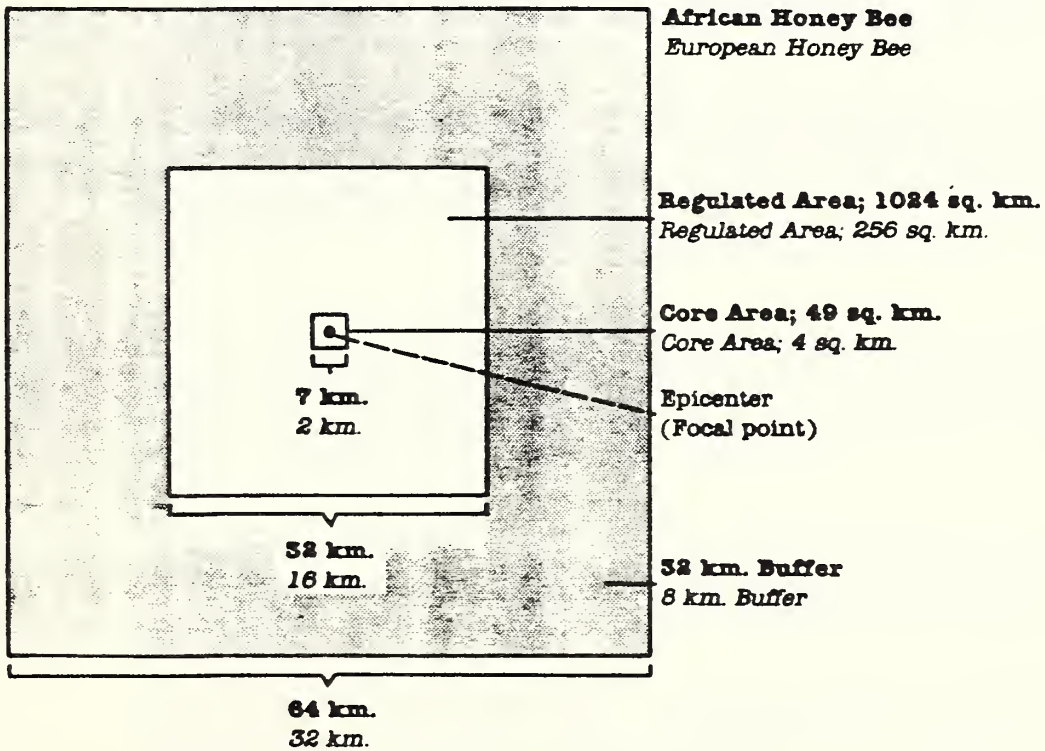
II. SURVEY PROCEDURES

The following survey procedures depend on the bees present in the area where the detection is made. If only European honey bees are known within the regulated area, the criteria for these bees may be used. If, however, African honey bees are present anywhere in the regulated area, the criteria for African honey bees must be used.

A. Delimiting Survey

When one or more acarine mites are detected in an area, a delimiting survey will be implemented immediately to determine if other mites are present on bees in the area and the extent of the infestation.

Survey Area



Using the site of detection as the epicenter (focal point), an area of 256 square kilometer (sq km) (98.9 square mile (sq mi)) for European honey bees or 1,024 sq km (395 sq mi) for African honey bees is established as the regulated area in which all phases of the project will be carried out. A buffer area of another 8 km (5 mi) for European honey bees and 32 km (20 mi) for African honey bees beyond the affected area is established in which survey activities will be carried out. All feral nests and colonies within the core area will be destroyed and examined. All managed apiaries within the core area will be surveyed by making collections.

If a mite is detected in an apiary, secondary inspection lists should be developed to include supply and distribution outlets and locations where hives had been moved going back a minimum of 3 years.

These outlets will be inspected and specimens collected by a sampling technique (see Addendum F, 5). State cooperators will be notified of high-risk acarine mite premises in their respective States, based on the site inspection lists that have been prepared.

A comprehensive survey of all apiaries and beehives in the regulated and buffer areas is to be carried out semiannually. The dissectioning technique will be the primary survey method. Surveys are to be conducted for 3 years following the last mite detection.

B. Monitoring/ Evaluation Survey

A monitoring/evaluation survey will be conducted in any area where eradication treatments are applied. An inspection is carried out 6 months after treatment and repeated on a semi-annual basis for a 3-year period of time.

C. Detection Survey

A survey of apiaries for a distance of 10 mi (16 km) for European honey bees or 40 mi (64 km) for African honey bees beyond the buffer area will be carried out with the cooperation of beekeepers.

In conjunction with the above, a limited survey of managed colonies will be carried out in the area defined above. This will consist of a check of a minimum of 20 percent of the colonies in each apiary as follows:

A sample of 100 bees taken from each of the apiaries will be examined. Bias will be towards bees displaying unhooked wings, are unable to fly, are moribund, are crawling near the hive

entrance, or even clustered near the hive. Colonies of bees which do not develop normally, exhibit symptoms of dysentery, and have a high mortality rate in winter are also suspect.

D. Orientation of Survey Personnel

Only trained or experienced personnel will be utilized. Replacement personnel will be trained by the State apiculturist, an extension bee expert, or an experienced beekeeper. A training period of sufficient duration will be scheduled for the orderly transfer of these functions.

E. Survey Records

Records noting the areas surveyed, sites inspected, dates, locations, hosts, and any other relevant data will be maintained (see Addendum G).

III. REGULATORY PROCEDURES

A. Instructions to Officers

Regulatory actions will continue until the infestation has been declared eradicated. Officers must follow instructions for regulatory treatments or other procedures when authorizing the movement of regulated articles. Understanding the instructions and procedures will serve as a basis for explaining such procedures to persons interested in moving articles affected by the quarantine and regulations. Only authorized treatment procedures may be used.

B. Regulated Articles

1. All honey bees.

2. Used equipment and hives.

3. All comb.

4. Pollen.

5. Any other product, article, or means of conveyance, of any character whatsoever, when it is determined by an inspector that they present a hazard of spread of acarine mite, and the person in possession thereof has been notified.

C. Quarantine Actions

When detections are made, implement the following in sequence:

1. With the detection site considered the epicenter, all establishments and individuals known to be involved in the handling, moving, or processing of bees and combs within the core or buffer areas will be issued emergency action notifications requiring treatment or other approved handling procedures. Emergency Action Notification (PPQ Form 523) and/or comparable State notifications are issued by field personnel to any individual or managers of establishments known to be handling, moving, or processing bees, equipment, containers, or products capable of spreading acarine mite. A notification may be issued pending authoritative confirmation and/or further instruction from the Deputy Administrator.

2. If necessary, the Deputy Administrator will issue a letter directing PPQ field offices to initiate specific emergency actions under the Federal Plant Pest Act (7 U.S.C. 150dd) until emergency regulations can be published in the Federal Register.

The Federal Plant Pest Act of 1957 provides for authority for emergency quarantine action. This provision is for interstate regulatory action only; intrastate regulatory action is provided under State authority. However, if the Secretary of Agriculture determines that an extraordinary emergency exists and that the measures taken by the State are inadequate, USDA can take intrastate regulatory action provided that the Governor of the State has been consulted and a notice has been published in the Federal Register.

The Organic Act of 1944, as amended, provides the Federal Government, either independently or in cooperation with States or political subdivisions thereof, farmer or beekeeper associations and other similar organizations, and individuals, the authority to carry out operations or measures to detect, eradicate, suppress, control, or to prevent or retard the spread of plant pests. This Act does not provide for trespassing on private property, but relies upon State authority and willingness to use State right-of-entry authority.

All program technology and methodology employed are determined through discussion, consultation, or agreement with the cooperating State officials.

3. The Deputy Administrator, through the National Regional Directors, will notify State cooperators of the acarine mite detection, actions taken, and actions contemplated.

A narrative description of the regulated area with support documents will be developed by USDA and cooperators and provided to the Regulatory Services Staff, National Program Planning Staff (NPPS). The regulated area will be defined by the Universal Transverse Mecator grid marketing system for use by the Project Manager.

4. APHIS Regulatory Coordination Staff will publish in the Federal Register emergency regulations under the Federal Plant Pest Act. A 60-day comment period will also be provided.

5. After a reasonable time, taking into consideration such factors as the biology of the pest, climatic conditions, and infestation spread, a proposal to promulgate a quarantine under the Plant Quarantine Act will be published. The proposal will announce a date for submitting written comments, which shall be approximately 60 days after publication.

6. After receipt of written comments, a final determination specifying the action decided upon will be published in the Federal Register. If after consideration of the comments a quarantine is warranted, it would be invoked under the Plant Quarantine Act.

D. Regulated Establishments Inspection

Efforts to detect the pest within the regulated area will be at and around all establishments where regulated articles are sold, handled, processed or moved, including apiaries.

E. Use of Authorized Chemicals

Addendum F of this Action Plan contains the authorized chemicals, methods of application, rates, and any special application instructions. Concurrence by the PPQ's Survey and Emergency Response Staff, NPPS, is necessary for the use of any chemical or procedure for regulatory purposes.

F. Approved Regulatory Treatments

1. Inspection and Certification

a. Bees cannot be moved out of the area since there are no regulatory treatments.

Hives Without Bees: Inspection by visual means, using the procedure outlined in the detection survey for each hive in the establishment.

Pollen: Eligible for certification after a 12-hour holding period.

b. Inspection of vehicles and shipping and storage containers that pose a hazard.

2. Decontamination

All contaminated articles including supers, frames, wax, and combs will be rendered free of bees for a period of 12 hours.

G. Principal Activities

The following identifies principal activities necessary for conducting a regulatory program to prevent the spread of the acarine mite.

1. Advising regulated industry of required treatment procedures.

2. Supervising, monitoring, and certifying commodity shipments of regulated articles.

3. Contacting:

a. Commodity markets.

b. Apiarists/beekeepers.

c. Commercial haulers of beehives and other regulated articles.

4. Monitoring the movement of regulated articles through major airports and other transportation centers.

5. Monitoring major highways and quarantine boundaries for movement of regulated articles.

H. Orientation of Regulatory Personnel — Only trained or experienced personnel will be utilized initially. Replacement personnel will be trained by the individual being replaced. A training period of 3 working days is necessary for the orderly transfer of these functions.

I. Regulatory Records — Records will be maintained, as necessary, to carry out an effective, efficient, and responsible regulatory program (see Addendum G).

IV. ERADICATION PROCEDURES

Survey and Emergency Response Staff, in consultation with methods and research agencies, outlines treatments to be used and staff must be notified of all treatment plans. If treatments selected or proposed are not in conformance with current pesticide labels, an emergency exemption can be provided under Section 18 of the FIFRA, as amended. For further instructions, see the Emergency Programs Manual, Section V, B.

A. Recommended Materials

1. Insecticides

Allethrins	Lindane
Bendiocarb	Malathion
Bromopropylate	Methoxychlor
Cyanide	Propoxur
Diazinon®	Pyrethroids
Dichlorvos	Resmethrin

2. Solvents/Other

Kerosene
Heating Oil
Diesel Fuel
Ammonia
Ammonia plus Water plus Soap

B. Approved Eradication Treatments

1. Destruction of Feral Swarms and Nests

When a resting swarm is located, clear immediate area of persons and animals. If possible, turn off any nearby machinery.

After donning proper protective gear, the swarm may then be sprayed with a quick knockdown material. If the swarm is in an enclosed space, it may be possible to treat the area with an automatic microgenerator or spray unit. If a spray is employed, concentrate the material on the swarm.

The material should be directed into the nest and any observable openings used frequently by the bees. Nest disposal will include destruction of bees, brood, and comb.

2. Destruction of Mites in Managed Colonies

Colonies will be subject to quick knockdown treatment with any approved material.

3. Pesticide Application

a. Ground application of pesticide can be used in selected locations. The pesticide will be applied to plants that foraging bees frequent. The material will be applied as a spray every 10 to 14 days.

b. Full coverage aerial pesticide application as an ultralow-volume spray can be used where conditions warrant. The pesticide will be applied every 10 to 14 days.

4. Solvent/Other

Application of recommended solvent/other materials will kill bees in a nest or hive. In an enclosed space which can be sealed off, solvents will work as quickly as most insecticides, and a 10- to 15-second drench may be sufficient. All bees should be dead within a short period of time. While this technique is not feasible in open areas, a swarm enclosed by a net, bag, or other covering can be safely disposed of with these materials.

C. Eradication/ Control Method Selection

The following parameters or criteria will determine the minimum treatments to be used in achieving eradication. Expanded or additional treatment actions can be applied if mutually agreed upon by cooperating agencies.

Eradication activities will continue until eradication has been declared or a minimum of 1 year. Detection activities will be performed in the regulated area for a period of 2 years after eradication has been declared. An active public information and assistance program will also continue through the 2-year period after eradication has been declared.

1. If any living stage of acarine mite is detected, all feral nests and swarms and managed colonies within the core area will be destroyed. A delimiting survey will also be conducted throughout the regulated area.

2. If 2 to 25 detections are made and mites are found on European honey bees, all managed colonies and feral colonies in and within 2 km (1.2 mi) of the core area will be destroyed. If necessary, pesticide applications will be made over the core area. A delimiting survey will be conducted throughout the regulated area. If 2 to 6 detections are made and mites are found on African honey bees, all the above will apply.

3. If more than 25 detections are made and mites are found on European honey bees, all managed and feral colonies within the area are to be destroyed. If more than 6 detections are made and mites are found on African honey bees, all of the above will apply. If necessary, pesticide applications will be made over the entire regulated area.

D. Orientation of Eradication/Control Personnel

Only trained and experienced personnel will be utilized. Replacement personnel will be trained by the individual being replaced. A period of 3 working days is necessary for the orderly transfer of these functions.

E. Eradication/Control Records

Records noting the location, detection, dates, number and type of treatments, and materials and formulations used will be maintained for all areas treated (see Addendum G).

F. Monitoring

An effective monitoring program will be implemented to aid in the evaluation of program efforts and environmental impact. The application and use of pesticides and other controlled substances will be assessed through the use of appropriate monitoring program criteria. The evaluation must effectively address Agency, cooperator, and public concerns.

The monitoring program for sampling to evaluate effects on environmental components will include at the minimum the following elements:

1. Determining efficacy of pesticide against the target pest.

2. Evaluating dye cards to monitor aerial applications.

   a. Droplet size information.
   b. Droplet distribution information.
   c. Identification of wind drift components.
   d. Verification of spray block boundaries.

3. Sampling to evaluate effect on environmental components.

   a. Water sampling to detect insecticide levels through direct application, leaching, and runoff.
   b. Soil sampling to determine insecticide levels and residues.
   c. Foliage sampling to identify residues.
   d. Biological organism sampling during applications and posttreatments to determine impact of insecticides.
   e. Air sampling to determine presence of pesticides in

respirable air.

4. Comb, honey, and pollen sampling to determine presence of pesticide residues.

The monitoring program is to be a combined effort between the State in which the emergency program is being conducted and PPQ. If specific plans need to be developed for monitoring activities, the Survey and Emergency Response Staff will request assistance and guidelines from other NPPS staffs.

V. CONTACTS

When an acarine mite eradication program has been implemented, its success will depend upon the voluntary cooperation, assistance, and understanding from other involved groups. The following is a list of groups which either are involved or should be kept informed of the operational phases of an emergency program.

A. Other Federal, State, county, and municipal agricultural and apiary officials and specialists

B. Apiculturist organizations

C. Trade groups, shipping companies, etc.

D. Universities

E. State and local law enforcement officials

F. Public health agencies

G. Foreign agricultural interests

H. National, State, and local news media

I. General public

J. Post Offices

VI. ADDENDA

Addendum A--Definitions

Acarapis woodi (Rennie):	The scientific name for acarine mite.
Beeswax:	Wax secreted from glands on the underside of the bee abdomen.
Buffer Area:	The area extending beyond the boundary of the regulated area, 8 km (5 sq mi) for European honey bees and 32 km (20 mi) for African honey bees.
Colony:	An established nest of honey bees consisting of queen and worker bees, with or without drones, organized as a social community.
Confirmed Detection:	A positive laboratory identification of submitted life forms (specimens) as acarine mite.
Core Area:	An area of a minimum of 4 sq km (2.5 sq mi) for European honey bees and 49 sq km (30 sq mi) for African honey bees around a confirmed acarine mite infestation.
Delimiting Survey:	A survey conducted to determine the extent of the infestation in an area where acarine mite has been detected.
Detection:	The collection of any life stage of acarine mite that obviously did not originate in the same square-mile area as any other detection.
Detection Survey:	A survey conducted in an area not known to be infested with acarine mite.
Epicenter/Focal Point:	The initial site of an infestation.
Feral:	Wild bees not kept or managed by man, either as a swarm or nest.
Frame:	A rectangular frame, stacked inside the hive with other frames, on which bees build comb for brood rearing and honey storage.
High-Risk Locations:	Areas where beekeeping activities are centered, bees are present, and regulated articles may be processed or sold.

Hive:	A man-constructed home for bees.
Honeycomb (comb):	A structure of beeswax built by bees in an array of hexagonal cells for storing nectar, honey, and pollen and for reproducing brood.
Host:	A bee species that provides shelter and nourishment for the mite.
Infestation:	The presence of one or more live specimens in any stage of development when collected or trapped under such circumstances that the specimen obviously originated in the area.
Infested Area:	The area so declared by program officials where criteria for "infestation" have been met.
Monitoring/Evaluation Survey:	A survey conducted in an area where an eradication treatment has been applied and the effectiveness of the treatment is being evaluated.
Nest:	A feral colony of bees, usually in a protected space.
Nucleus:	A small colony of bees.
PPQ-APHIS-USDA:	Plant Protection and Quarantine, Animal and Plant Health Inspection Service, United States Department of Agriculture.
Preferred Nesting Site:	Any protected space ranging in size from 3 to 7 cubic feet (0.08 to 0.2 cubic meters) such as in attics, sheds, farm machinery, etc.
Regulated Area:	A geographical area of 256 sq km (159 sq mi) for European honey bees and 1,024 sq km (636 sq mi) for African honey bees.
Smoker:	Device used to blow smoke on bees to reduce stinging.
Super:	The basic rectangular outside walls of the hive with removable top and bottom. Usually 2 to 4 are stacked up to form a single hive with a common interior and frames hung on each super.

Swarm:	One or more queens with accompanying bees in moving status.
Treatment Area:	An area where treatments are being carried out.

Addendum B—Safety

1. GENERAL INFORMATION

Personnel and public safety must be prime considerations at all times. Safety practices should be stressed in preprogram planning and through the duration of actual program operations. Supervisors must enforce on-the-job safety procedures. For complete instructions, see V, D, in the Emergency Programs Manual.

2. PRECAUTIONS

The African honey bee can be more defensive in the immediate area of the hive. For this reason, every precaution must be taken to avoid being stung, since the initial sting can lead to repeated stinging or a full-scale attack on anything moving. Personnel hyperallergic to bee venom should not be assigned to project activities. African honey bees will also sting domestic animals.

3. GENERAL PUBLIC PROTECTION

a. Advise people not to disturb honey bees if sighted.

b. Request people seeing swarms or colonies of bees to inform USDA, State regulatory officials, extension personnel, or pest control operators so that swarms or colonies can be disposed of safely.

c. Advise people who experience dizziness or difficulty in breathing after having been stung that they should be treated by medical personnel as soon as possible and preferably within 20 minutes. People (other than beekeepers), who are stung repeatedly, should be taken to a medical facility and examined in case treatment is necessary. A single bee sting is seldom fatal. Swelling of the affected area is a normal reaction to bee stings.

d. Practical first aid measures for stinging victims are:

(1) Remove stings with sideways movement of fingernail to prevent more venom from being pumped in by the venom sac. Do not attempt to use tweezers or squeeze sting, as this will inject more venom into victim.

(2) Apply paste of baking soda and cold cream.

(3) Apply an icepack to relieve pain and calamine lotion to relieve itching.

(4) Watch for any unusual reactions, in particular, the appearance of hives anywhere on the body in 2 to 20 minutes or breathing difficulties. Such signs indicate immediate medical assistance is needed.

Note: Antihistamine tablets, injections, or other antiallergic medication should only be given by qualified medical personnel.

4. SAFETY EQUIPMENT

a. Beekeeper hat and veil
b. Two light-colored shirts
c. Two pairs, light-colored pants
d. One pair, light-colored boots
e. One, light-colored belt
f. One pair, sting-proof gloves
g. One pair, light-colored coveralls
h. Smoker, large

5. HONEY BEE ATTACK

In the event a honey bee attack occurs, the officer may be called on at any time to assist.

a. If the attack is in progress: (1) Do not expose other people or personnel to extra risk. (2) If attempting to rescue animals, do not risk having protective clothing ripped by the animal. (3) Immediately spray the area with an insecticide spray or fogger. (4) If insecticides are not available immediately, throw a double bag of heavy white cloth about the victim and remove him/her from the area of bee activity. (5) Seek medical attention for the victim.

b. If an attack has left people injured, provide necessary assistance in obtaining medical attention.

Addendum C--Hosts

The following two species of bees are the only ones presently known to serve as hosts:

Scientific Name	Common Name
Apis cerana Fabricius	Eastern Honey Bee (Indian, Black, and Brown Bees)
Apis mellifera Linneaus	Western Honey Bee (European and African Honey Bees)

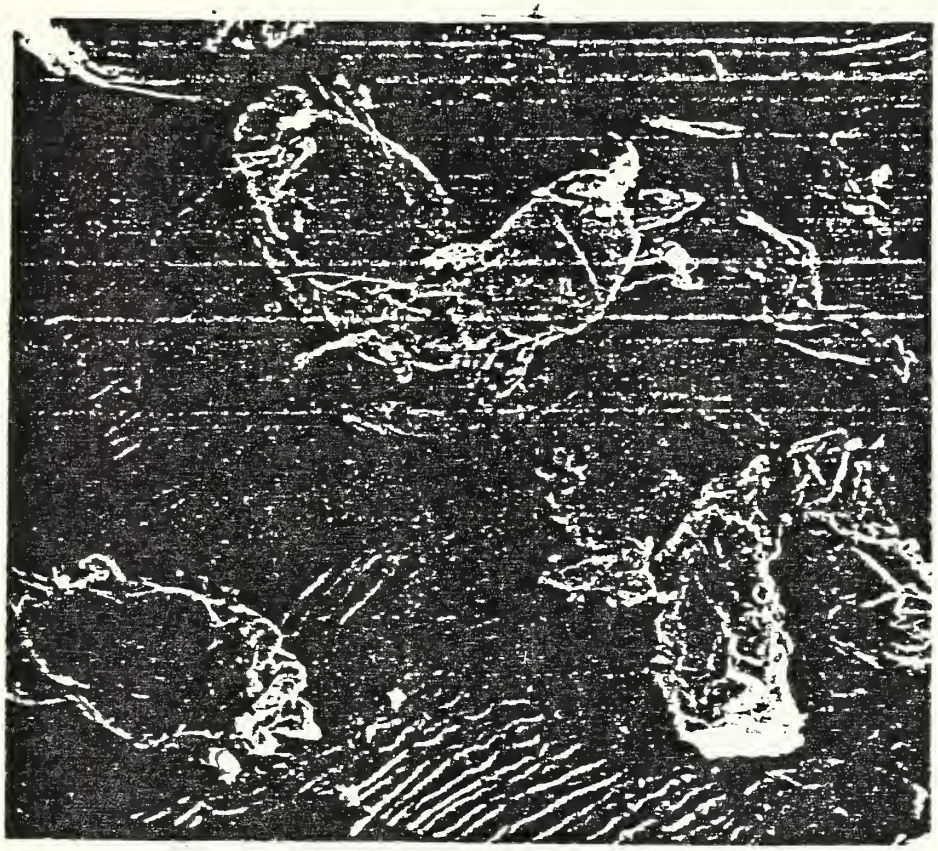


Figure 1—Acarapis woodi. a. Mature female. b. Mature male. c. Larva within its eggshell. d. Larva.
The actual sizes of the various stages are variable but the males are always smaller than the females.

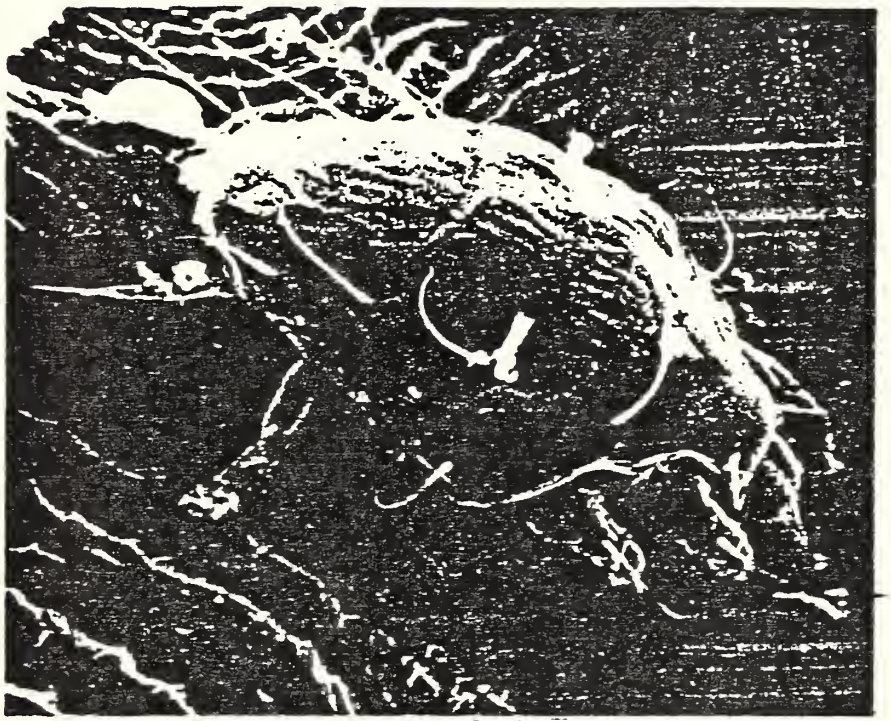


Figure 2—Female Acarapis woodi dorsal view
(SEM by W. E. Styer)

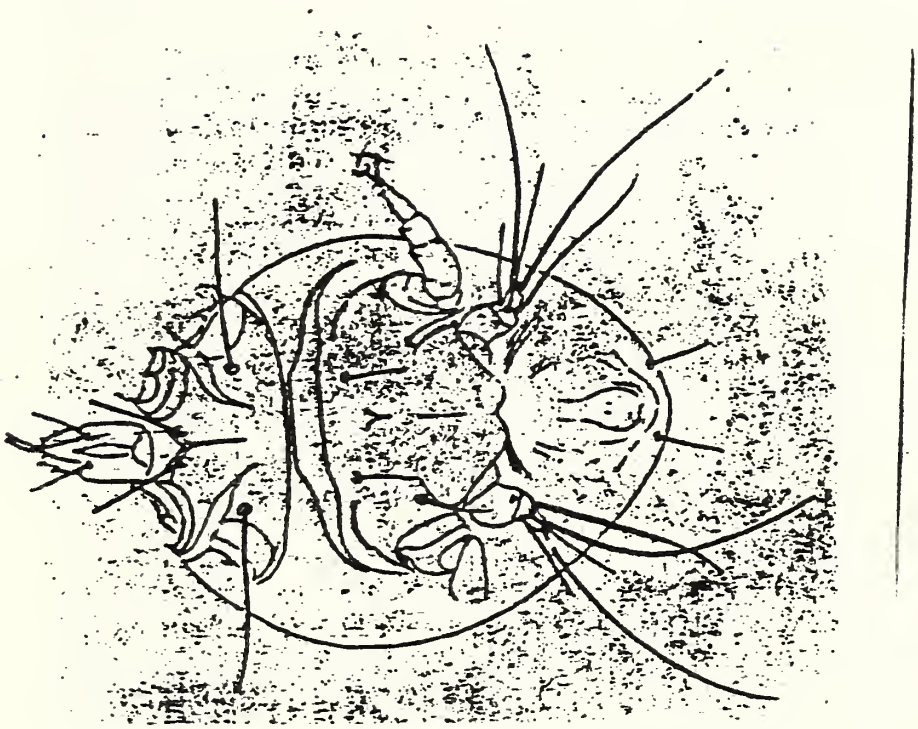


Figure 3—Female Acarapis woodi ventral view (line drawing by E. W. Baker)

Eggs: About the size of a mature mite and laid in the tracheae of the bee.

3. BIOLOGY

Characteristic Damage: The life span of infected bees is significantly shortened. Because they are unable to fly, large numbers of bees can be seen crawling on the ground near the hive. Diseased bees will often drop to the ground from the alighting board or while flying and may also gather in small clusters near the hive.

The tracheae of diseased bees is obstructed by mites in different stages of development, as well as by mite debris. Feeding by the mites damages the walls of the tracheae. The tracheae, which are normally white, turn black. Tracheae that are normally elastic and flexible become stiff and brittle. Discoloration and atrophy of the flight muscles may also occur.

Another symptom is the abnormal "dislocated" position of the wings of walking bees. Infested colonies do not develop normally and may exhibit symptoms of dysentery and have a high mortality rate in the winter months. These colonies may often show an excessive swarming tendency.

Detection Notes: Because of the increased mortality of colonies in winter, it is important to detect the infestation before the winter clustering period. A positive diagnosis of the disease is made by examining the bee trachea for mites (Figure 5). Suspect bees that appear unable to fly or have unhooked wings should be examined for mite infestation by removing the bee's head, front legs, and first skeletal ring.

The tracheae can be examined for mites with a dissecting microscope. The specimen can be cleared with a 5 percent potassium hydroxide (KOH) solution, lactic acid, or lactophenol. The suspect tracheae can be examined more closely under a coverslip on a slide.

Biology The biology of this species has not been worked out in detail. The life cycle apparently is completed in the bee trachea.

The eggs are laid in the tracheae of the bee one at a time. Each female can lay from 5 to 7 eggs. The egg stage may last 3 to 6 days, from which a six-legged larva emerges. The larvae complete their development and emerge as mature adults from the first thoracic spiracle. The adults move from one bee to another until they encounter a young bee before entering the trachea. Bees less than 9 days old are the most susceptible.

Addendum E—Identification of Mites

Specimens are to be collected for identification by the local designated identifier. Specimens identified by area identifiers as acarine mite or suspect mites are to be forwarded in vials of alcohol for confirmation to 1/ below. These should be accompanied by PPQ Form 391 and marked "Urgent" (see PPQ Manual M390.500).

INFORMATION FLOW FOR THE IDENTIFICATION OF PARASITIC MITES AND UNDESIRABLE SPECIES OF HONEY BEES

SPECIMEN COLLECTED

↓

IDENTIFICATION BY STATE
Laboratory (Optional)

↓

SPECIMEN SUBMITTED TO USDA 1/
for Confirmation

↓

CONFIRMATION NOTIFICATION 2/
to Other USDA Agencies

↓

RESULTS SENT TO APHIS AND IF EXOTIC
Information Relayed to

APHIS/ARS 2/ All States 3/ NAPPO 4/ AIA 5/ CAPA 6/

1/ Honey Bee Disease Diagnostic Laboratory
Agricultural Research Service
U.S. Department of Agriculture
Building 476, BARC-EAST
Beltsville, Maryland 20705

2/ APHIS Plant Protection and Quarantine

3/ All States State and Territory Agricultural Regulatory Officials

4/ NAPPO North American Plant Protection Organization

5/ AIA Apiary Inspectors of America

6/ CAPA Canadian Association of Professional Apiculturists

Addendum F--Technical Application Data

1. BEE KNOCKDOWN

A. Solvents/Other Materials

Application of an approved solvent/other materials will kill bees in a nest or hive. In an enclosed space which can be sealed off, these materials will work as quickly as most insecticides, and a 10- to 15-second drench may be sufficient. All bees should be dead within a short period of time. While this technique is not feasible in open areas, a swarm enclosed by a net, bag, or other covering can be safely disposed of with solvents.

Approved Materials:

Kerosene
Heating Oil
Diesel Fuel
Ammonia
Ammonia plus Water plus Soap
2 gallons (3.79 liters) water plus 1 pint (0.47 liter) cloudy ammonia plus sufficient liquid soap to make a sudsy solution.

B. Pesticides

Application of an approved insecticide will kill bees in a swarm or nest. In an enclosed space which can be sealed off, a 10- to 15-second application may be all that is necessary. All bees should be dead within 30 minutes after application. In an open space, spray should be applied until all bees have been knocked to the ground or are unable to fly. It may be possible to put a net, bag, or other covering over a swarm and then apply a spray. If bees attack people or animals, a spray or fogger may be directed into the approximate center of the disturbance.

Approved Insecticides:

Resmethrin—1% active ingredient as an aerosol is used as knockdown fogger material and is specifically registered for bee treatment.

Other insecticides which may be used but require approval:

Allethrins
Bendiocarb
Cyanide
Diazinon®
Dichlorvos
Lindane
Malathion
Methoxychlor
Propoxur
Pyrethrins
Pyrethroids

2. FOLIAR APPLICATIONS WITH GROUND EQUIPMENT

The following pesticides are not registered for use against honey bees. Any application must be approved by the Environmental Protection Agency (EPA).

Sevimol® 4—1.89 liters (L) (64 fluid ounces (fl oz)) of 40% carbaryl in 30 to to 100 gallons (gal) of water per acre depending on type of equipment or 4.67 (L) (158 fl oz) in 75 to 250 gal of water per hectare. Apply as a spray when detections are made.

Cythion®—118 (L) (40 fl oz) of 57% malathion in 40 to 100 gal of water per acre depending on type of equipment or 2.92 (L) (99 fl oz) in 100 to 250 gal of water per hectare. Apply as a spray when detections are made.

Cygon® 400—0.47 (L) (16 fl oz) of 43.5% dimethoate in 25 to 40 gal (94.6 to 131.4 L) water per acre depending on type of equipment or 1.17 (L) (40 fl oz) in 62 to 100 gal of water per hectare. Apply as a spray when detections are made.

Baytex® 4— 0.09 (L) (3 fl oz) of 45% fenthion in 40 to 100 gal of water per acre depending on type of equipment or 0.22 (L) (7.4 fl oz) in 100 to 250 gal of water per hectare. Apply as a spray when detections are made.

3. AERIAL APPLICATION

Sevimol® 4—113 (L) (32 fl oz) of 40% carbaryl in an equal amount of water per acre or 2.34 (L) (79 fl oz) in an equal amount of water per hectare. Apply as a spray when detections are made.

Ultralow-Volume (ULV) Malathion—0.35 to 0.47 (L) (12 to 16 fl oz) of technical (91%) malathion per acre or 0.89 to 1.18 (L) (30 to 40 fl oz) per hectare. Apply as a spray when detections are made.

Cygon® 400—0.47 (L) (16 fl oz) of 43.5% dimethoate in 1 or more gal of water per acre or 1.17 (L) (39 fl oz) in 2.5 gallons of water per hectare. Apply as a spray when detections are made.

Baytex® Liquid Concentrate Low Volume Spray—0.039 (L) (1 1/3 fl oz) of (93%) fenthion per acre or 0.097 (L) (3.29 fl oz) per hectare. Apply as a spray when detections are made.

4. ACARINE MITE ERADICATION TECHNIQUES

Mites will die if not infesting bees. Therefore, equipment or materials will be free of mites after a period of 12 hours.

a. Bee Depopulation From Hives—Cyanide

During the day all cracks, crevices, and holes other than the entrance should be taped. At dusk or later place 1 to 3 tablespoonfuls of calcium cyanide on a file folder or similar cardboard and insert it into the hive entrance. The entrance is than taped shut. The lower dosage is used for a single hive body and the higher dosage for hives with more supers. Any honey in the hive at the time of treatment cannot be used for human consumption. It may be used for bee food. An hour or more after the cyanide has been introduced the hive should be opened and the spent dust and dead bees removed. Catch hives should be placed in a beeyard when fumigation is underway to capture those bees that are out of the hives at the time they are treated. These should be treated using the same method following the evening. An emergency exemption for use of cyanide must be obtained from EPA for each State where it is used.

b. Microgenerator

Microgenerators will produce a fine mist or fog suitable for quick application of pesticides in large enclosed spaces such as attics where some nests may be found. Use in accordance with directions.

5. ACARINE MITE SURVEY TECHNIQUES

a. Sample Collection

A sample consisting of 100 bees should be collected from each selected apiary. This collection should be a pooled sample of 5 to 10 bees from each colony. Try to collect moribund bees that may be crawling near the hive entrance. Do not collect bees that have been dead for an indeterminate period as they are less than ideal for acarine diagnosis.

Bees collected at the entrance as they are leaving or returning to the hive are ideal. If desired, a sweep net can be used to collect bees at the hive entrance.

Bees collected within the hive must be taken from honeycomb only, as brood comb will generally have young bees unlikely to be infested or may be collected from under the hive cover. End hives in a beeyard or hives at or near a honey house will have a mix of stray bees and should be included in the sampling.

Kill the bees immediately in a killing jar and then transfer them directly into a container partially filled with 70 percent alcohol or place the bees directly into the alcohol.

b. Screening Samples for Mites

Samples should be processed within 8 weeks of collection either by the State cooperator or a PPQ Area Identifier as agreed to at the local level. If samples cannot be processed within this time frame, they should be sent forward to the Bioenvironmental Bee Laboratory in Beltsville, Maryland.

Fifty bees from each sample should be selected for dissection. Examination for the internal mite, A. woodi, will be done using one of the methods prescribed by the bee laboratory. The laboratory uses method number four. Examination for external mites will be accomplished by pouring the alcohol from the initial sample container through a filter and examining it through a dissecting microscope.

c. Diagnostic Procedures

Method 1. Pin the bee on its back and remove the head and first pair of legs by pushing them off with a scalpel or razor blade in downward and forward motion (Figure 4). Using a dissecting microscope, proceed to remove the first ring of the thorax (the collar or tergite) with a pair of tweezers. This exposes the tracheal trunks in the mesothorax (Figure 5). Healthy tracheae appear cream or white in color. Heavy mite infestations result in tracheae that have brown blotches or they may be black. When the infestation is light, it is necessary to remove the tracheae, place them on a glass slide in a drop of lactic acid for clearing and finally cover with a cover slip for examination using a compound microscope (430x).

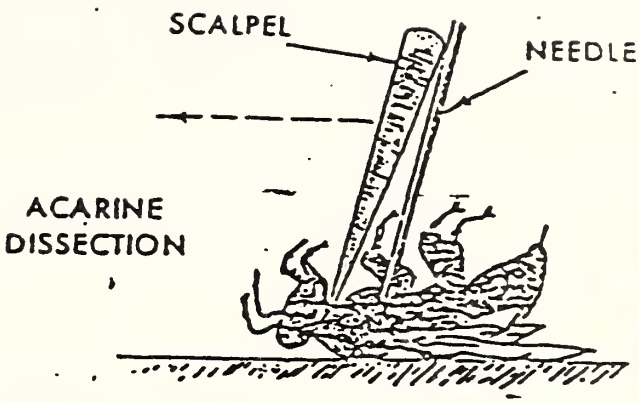
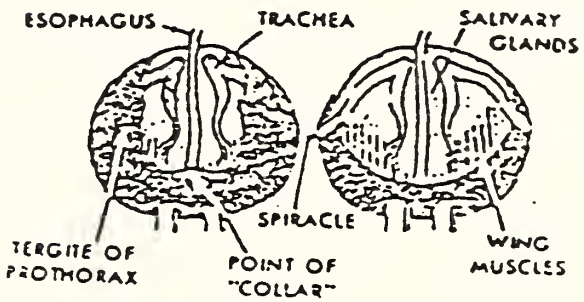


Figure 4 Positioning the bee for dissection and diagnosis of acarine disease.



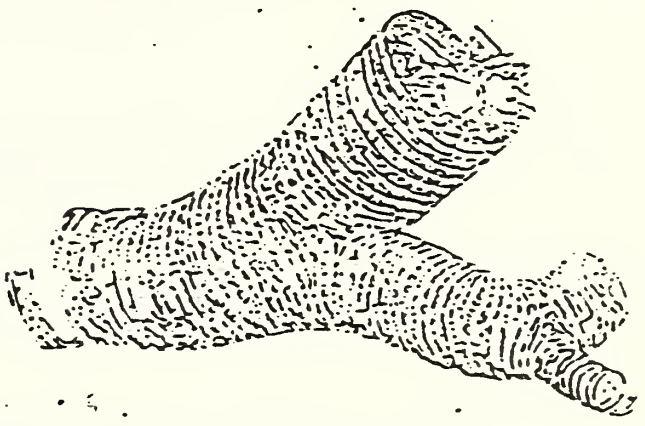


Figure 5 -Above, the location of the trachea in the thorax; below, sketch of the trachea containing acarine mites.

Method 2. Grasp the bee between your thumb and forefinger and remove the head and first pair of legs. Then with a scalpel, razor blade, or fine pair of scissors, cut a thin transverse section from the anterior face of the thorax in such a way as to obtain a disc. Place the disc on a microscope slide and add a few drops of lactic acid. This makes the material more transparent and also helps in separating the muscle. With the aid of a dissecting microscope, carefully separate the muscles, remove the tracheae, and examine the preparation as in Method 1.

Method 3. Cut a few thoracic discs as described in Method 2, place them on a slide, and add a few drops of 10 percent KOH. Heat the slide gently for 1 to 2 minutes--do not boil--cover with a cover slip, crush lightly, and examine microscopically. This procedure is advantageous when the bees have been dead for some time.

Method 4. Prepare transverse section discs from the thoraces of 50 bees as described in Method 2, place them in 5 percent KOH, and incubate at 37° C. for 24 hours. The KOH dissolves the muscle and fat tissue leaving the trachae exposed. The distrachae suspension can then be examined under a dissecting microscope. Suspicious trachae can be removed from the discs and examined microscopically (430x).

Method 5. Remove the heads, abdomens, wings, and legs from 20 to 200 thoraxes and place them in a homogenizing jar with 25 ml of water. Homogenize three times for several seconds at 10,000 revolutions per minute in a homogenizer using just enough water to rinse the inside of the jar. The suspension is then strained through a 0.80-mesh sieve and rinsed with water. The final volume of the filtrate should be about 50 ml. Centrifuge the filtrate at about 1,500 G'S for 5 minutes and discard supernatant. A few drops of lactic acid is then added to the preparation and allowed to stand for 10 minutes. The sediment can now be placed on a slide for examination. If you use this method, you will need a microscope with an oil immersion objective to correctly identify A. woodi, as there are other mites associated with honey bees that are morphologically similar. In any case, if you find any mites resembling A. woodi, send your specimen to a competent specialist.

6. SMOKERS

For the purpose of discovery and eradication of acarine mite, smokers should be employed to pacify bees, while inspecting hives.

If necessary to open a hive, a smoker should be used. The smoker depends on smoldering combustible material in a small enclosed space. Burlap bags cut into strips, wood chips, pine needles, and rolled cardboard may be used for this purpose. The material is lighted and dropped into the smoker where it will smolder.

Using a smoker, a hive is approached from the side or rear and the entrance is smoked gently to force guard bees inside. The cover is then raised at the rear and the frames inside gently smoked. When examining frames, break propolis seals between hive bodies and frames slowly and evenly, taking care not to jar or bump combs and bees.

Should bees become excited (especially if African), it is best to slowly replace the cover and back away. The smoker may be held near the body and directed towards oneself for additional protection until far enough away from the bees.

7. DETECTION OF FERAL BEES

It is usually difficult to locate feral nests and swarms. Three primary methods may be used to find feral bees. Local beekeeper assistance should be solicited when possible.

a. Public Reports

Whenever bees are reported by the general public, these reports will be checked out, and the nests or swarms located and destroyed. The location of such nests or swarms may involve local sighting, beelining, or other information.

b. Beekeeper Assistance

Inquiry may be made of beekeepers of any feral bees they know about or of likely places such bees may be found. Such locations are to be noted and followed up on as soon as is possible.

c. Beelining

Contact SERS for further information.

Addendum G--Forms

Number		Title
CONTROL		
REGULATORY	PPQ-523	Emergency Action Notification
SURVEY	PPQ-391	Specimens for Determination

Addendum H—References

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